Updates to the EPA Rating for Hotels

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Agenda

- EPA Ratings
  - Objective
  - Technical foundation
- Hotel Analysis
  - Data collection summary
  - Data set comparison
  - CBECS model results
  - Items for discussion
- Resorts
- Next Steps

EPA Ratings: Objective

- Help businesses protect the environment through superior energy efficiency
- Motivate organizations to develop a strategic approach to energy management
- Convey information about energy performance in a simple metric that can be understood by all levels of the organization

EPA

EPA Ratings: Objective

- Monitor actual as-billed energy data
- Create a whole building indicator
  - Capture the interactions of building systems not individual equipment efficiency
  - Track energy use accounting for weather and operational changes over time
- Provide a peer group comparison
  - Compare a building's energy performance to its national peer group
  - Track how changes at a building level alter the building's standing relative to its peer group

EPA

EPA Ratings: Technical foundation

- Analyze national survey data
  - Commercial Building Energy Consumption Survey (CBECS)
  - PKF Hospitality Research (PKF-HR), Trends in the Hotel Industry® database
- Develop regression models to predict energy use for specific space types based on operations
- Create scoring lookup table
  - Ratings are based on the distribution of energy performance across commercial buildings
  - One point on the ENERGY STAR scale represents one percentile of buildings
- Buildings that perform in the 75th percentile or better can earn the ENERGY STAR label

EPA

EPA Ratings: Technical foundation

- Develop the regression model
  - Account for building operations (e.g., Guest Rooms, Employees, Refrigeration, HDD, CDD)
- Apply a linear regression model

$$\text{Energy} = C_o + C_1*\text{GuestRooms} + C_2*\text{Workers} + C_3*\text{WalkinRefrigeration} + C_4*\text{HDD} + C_5*\text{CDD} + \ldots$$

  - Coefficients represent average responses
  - Coefficients provide adjustments for each operational characteristic
    - ***Does not*** add the kWh of each piece of equipment
    - ***Does*** adjust energy based on correlation between operating characteristic and energy use

EPA Ratings: Technical foundation

- The rating ***does***
  - Evaluate as billed energy use relative to building operations
  - Normalize for operational characteristics (e.g., size, number of employees, walk-in refrigeration, climate)
  - Depend on a statistically representative sample of the US commercial building population
- The rating ***does not***
  - Attempt to sum the energy use of each piece of equipment
  - Normalize for technology choices or market conditions (e.g., type of lighting, energy price)
  - Explain how or why a building operates as it does

Hotel Analysis: Data collection summary

- Kick-off meeting: April 30, 2008
  - EPA shared plans for model
  - Solicited data
- Data collection period: May and June
- Participation:
  - Three organizations
  - Approximately 65 hotels with complete energy and operational information
  - Number does not include 8 resort properties
    - Addressed separately at the end
- Analysis:
  - Your data is a supplement to provide a picture of the market: ***the rating model will be based on CBECS***

Hotel Analysis: Data set comparison

- Three data sets
  - CBECS 2003 survey
  - Data from 2008 partner survey
  - Portfolio Manager data (limited set of operational information)
- Comparison results
  - ***Both*** similarities ***and*** differences
- Conclusion
  - CBECS provides robust data set for model development
  - Other data supplements CBECS to assist in final decisions

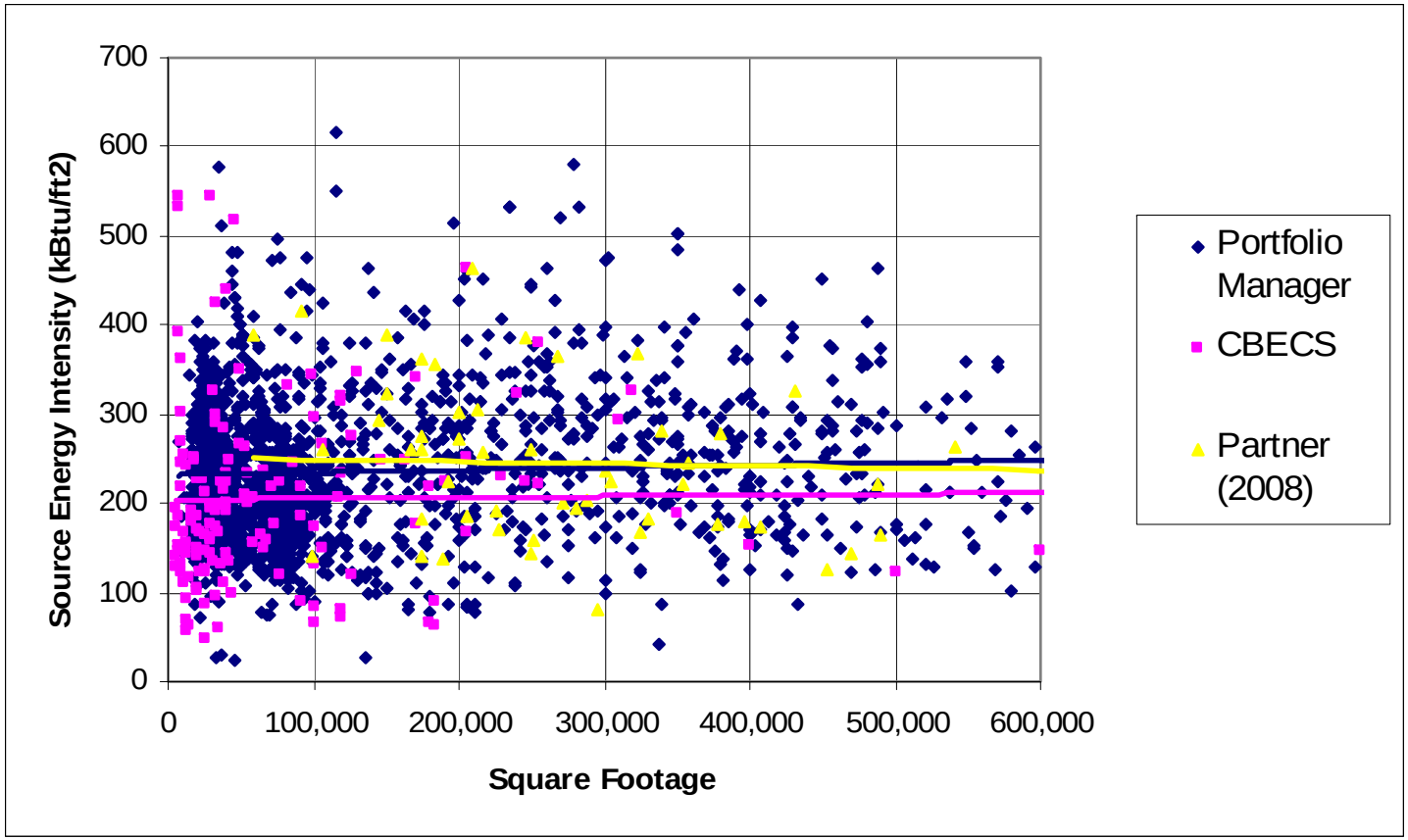
Hotel Analysis: Data set comparison

- Differences
  - The sizes of the hotels in each population are different
  - Portfolio Manager hotels are larger than CBECS
  - Partner Data (2008) hotels are the largest
    - Many more rooms than typical AHLA averages

	CBECS	Portfolio Manager	Partner Data (2008)
Hotel Size (square foot)	81,656	226,982	469,711
Average Number of Rooms	111	277	518
Average Number of Rooms per 1,000 square foot	1.93	1.51	1.21
Average Energy Intensity ($kBtu/ft^2$)	205	238	240

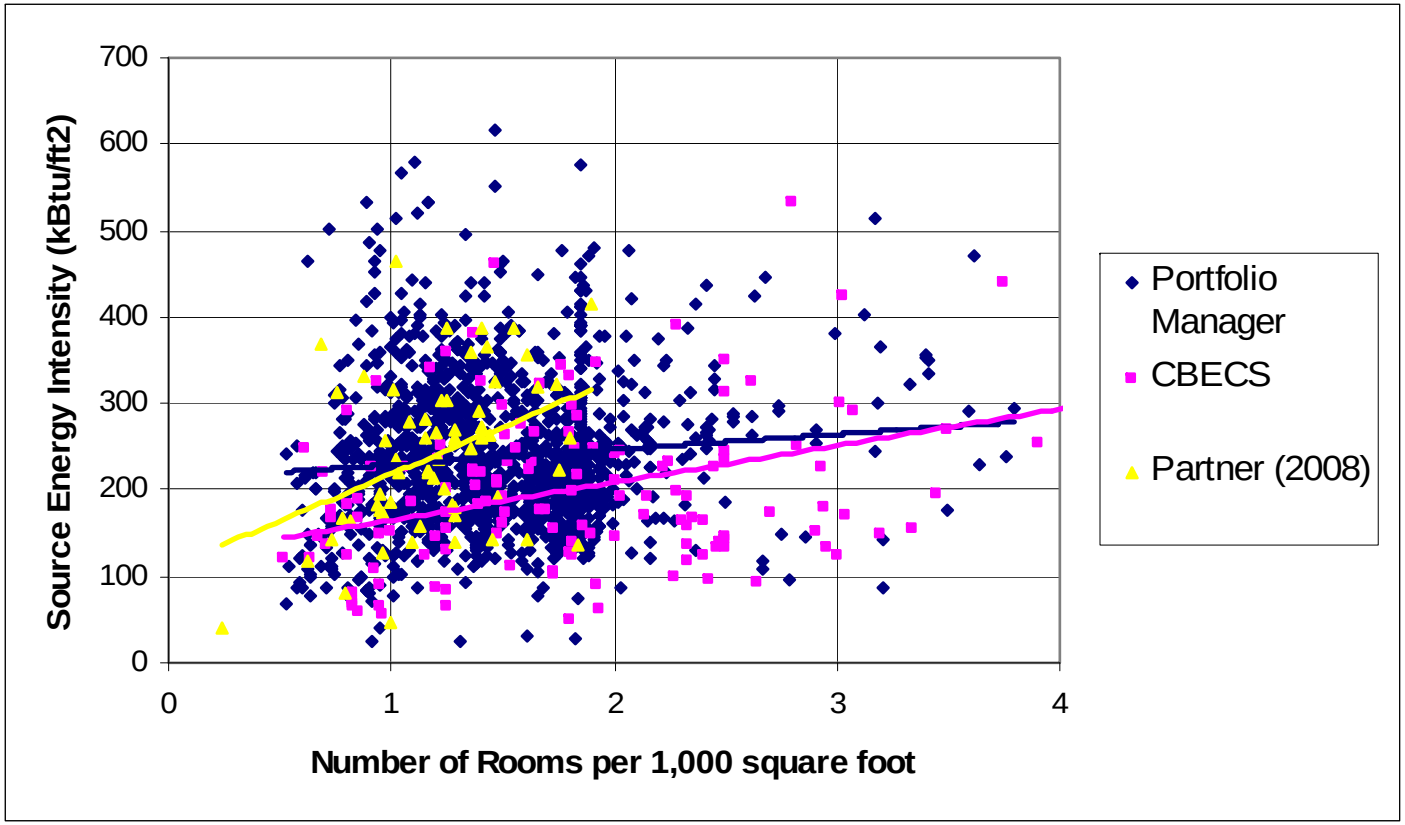
Hotel Analysis:
Data set comparison

- Similarities – Energy Intensity (EUI) relationships
  - Similar range of EUI values
  - Same range of EUI values across a wide range of square foot



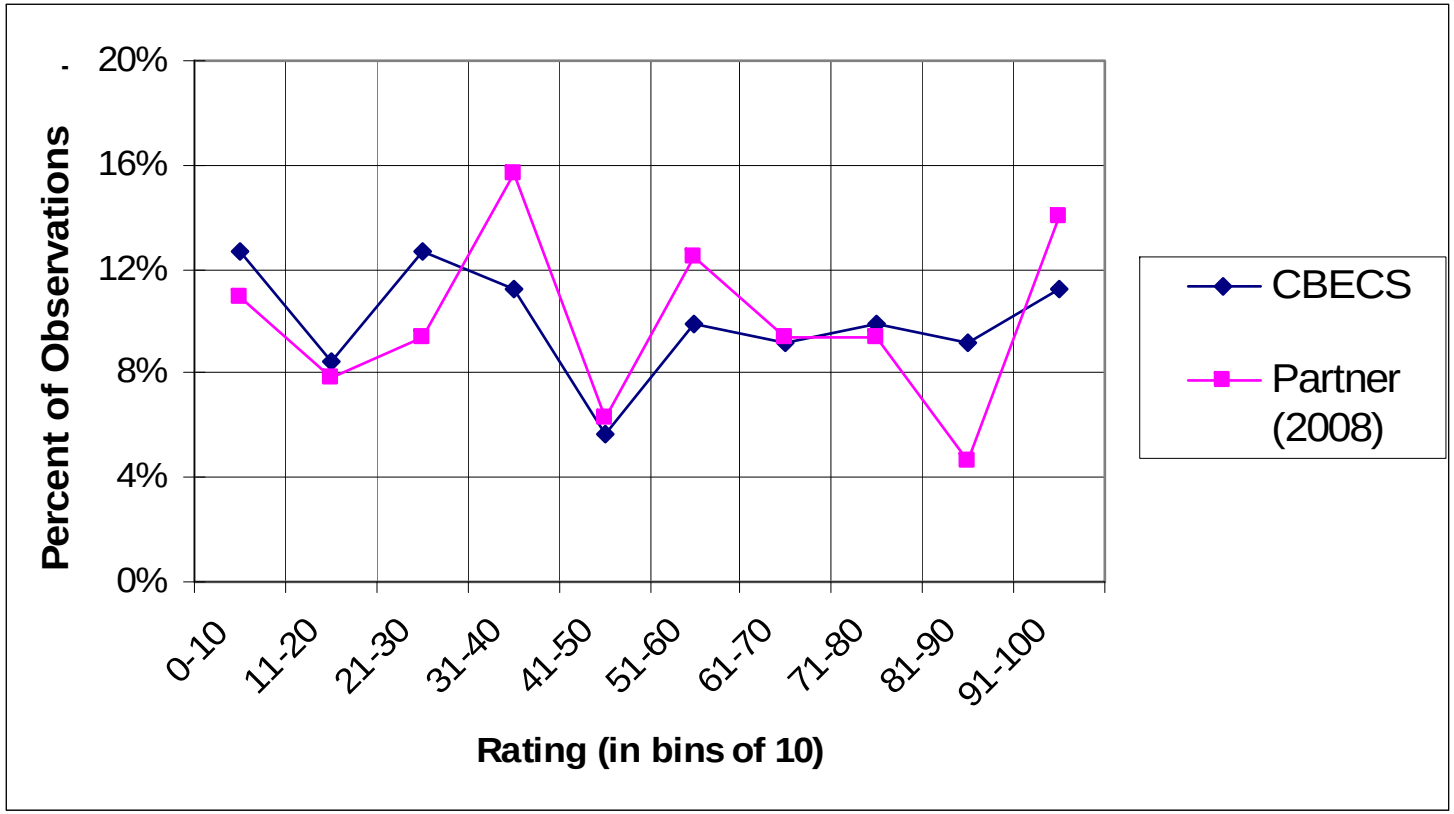
Hotel Analysis: Data set comparison

- Similarities – Energy Intensity (EUI) relationships
  - Similar range of EUI values
  - EUI increases with room density



Hotel Analysis:
Data set comparison

- Similarities - ENERGY STAR Ratings
  - Show similar distribution of ratings with final models under consideration
  - Portfolio Manager cannot be rated, requisite data not currently collected



Hotel Analysis: Data set comparison

- Conclusions
  - The hotels shared in 2008 are very different from the buildings in Portfolio Manager ***and*** the buildings in CBECS
    - More rooms
    - Larger gross floor area
  - Similar trends are observed in all three data sets
    - Energy use per square foot in the same range for a variety of sizes
    - Energy use per square foot increases with increasing room density
  - The population shared in 2008 shows similar rating behavior to the CBECS population
  - The three sets combine to show a good picture of the market
  - The three sets combine to enable thorough testing of all CBECS conclusions
  - CBECS models appear robust

Hotel Analysis: CBECS model results

- Survey year: 2003
- Dependent variable: Source EUI
  - Source Energy per square foot
- Linear regression to examine key operational characteristics
  - Size, number of rooms, number of workers, food preparation, servers and computers, pools, etc
  - Performed 100+ regression models to evaluate behavior
- Test model options using CBECS and your data

Hotel Analysis: CBECS model results

- Variables that are likely to be included in the new model
- Consistently statistically significant with 90% confidence or better

Operating Characteristic	Existing Model	New Model
Number of Rooms	Yes *(total #)*	Yes *(rooms/square foot)*
Heating Degree Days	Yes	Yes
Percent of Hotel Heated	No	Yes
Cooling Degree Days	Yes	Yes
Percent of Hotel Cooled	No	Yes
Presence of Cooking	*some categories*	Yes
Number of Commercial Refrigeration Units	No	Yes

Hotel Analysis: Items for discussion

- Notice new variables
  - Percent heated & Percent cooled
  - Presence of cooking (yes/no) for ***all*** hotels
  - Number of commercial refrigeration units
    - Includes walk-in refrigeration and freezers
    - Includes open and closed refrigeration cases
- What do you think of these variables?
  - Are they easy to report?
  - Can the percent heated and percent cooled be reported in bins of 10? (i.e. 10%, 20%, 30%...)

Hotel Analysis: CBECS model results

- Variables that may be included in the new model and are still under investigation by EPA
- Statistically significant in some model options with 80 to 90% confidence or better

Operating Characteristic	Existing Model	New Model
Number of residential refrigerators	No	Maybe
Number of workers	No	Maybe
Number of servers	No	Maybe

Hotel Analysis: Items for discussion

- Number of residential refrigerators
  - Includes full size residential-type units ***and*** smaller mini-bar units
  - Important – Some hotels offer mini-bars or full size units in hotel rooms while others do not
  - Not important – These units are small in comparison with heating, cooling, and cooking at a hotel

  → ***What do you think?***

- Number of workers
  - Important – Hotels with more workers offer more guest services and this is an important business distinction
  - Not important – The number of workers is typically correlated with the total number of rooms and is not expected to have a strong impact on energy consumption

  → ***What do you think?***

EPA

Hotel Analysis: Items for discussion

- Number of servers
  - Important – the number of servers captures varying levels of business activity and will be correlated with number of transactions and level of guest amenities
  - Not important – there are typically only a few servers and they are not key factors when compared with hotel size and other characteristics

→ ***What do you think?***

Hotel Analysis: CBECS model results

- Variables that are ***not*** likely to be included in the new model
- Not statically significant in any model formulations
- Not available in the CBECS data set

Operating Characteristic	Existing Model	New Model
Hotel amenity category	Yes	No
Presence of a pool	No*	No*
Presence of laundry facilities	No	No
Presence of spa	No	No
Presence of conference space	No	No

Hotel Analysis: CBECS model results

- Hotel amenity categories
  - Existing model uses five categories (economy to upper upscale)
  - CBECS analysis does ***not*** use these categories
    - Not available in CBECS
    - Not necessary in a model that includes more operating characteristics to measure business size
  - CBECS has two categories
    - Hotel and Motel/Inn
    - Examined separately and together
    - Do ***not*** require separate models or adjustments
  - Single, simple, method for all hotels
    - Model ***applies to*** economy, mid-scale, and upper/upscale hotels
    - Model ***applies to*** extended stay
    - Model does ***NOT*** include resorts at this time

Hotel Analysis: CBECS model results

- Presence of a pool
  - Available as a yes/no variable in CBECS Survey
  - Not statistically significant as a regression variable
  - EPA provides engineered adjustments for pools in Portfolio Manager
  - Adjustment provides accurate ratings for CBECS and partner-supplied data
  - ***Although not a "variable" in the regression, appropriate adjustments are included***

- Presence of laundry facility
  - Available as a yes/no variable in CBECS Survey
  - In the CBECS and parter-supplied data, buildings with laundry facilities actually report using ***less*** energy
  - No evidence to support a regression adjustment for laundry
  - No evidence that the exclusion of laundry from the regression introduces a bias

Hotel Analysis: CBECS model results

- Presence of a spa
  - Not available data in the CBECS survey
  - Over 95% of the 65 hotels that provided data to EPA reported a spa
    - Your hotels are generally larger than CBECS or Portfolio Manager
    - Your hotels are more likely to have spas
  - CBECS hotels and your hotels achieve similar rating distribution with the models
    - There is no evidence for a bias with respect to spas

Hotel Analysis: CBECS model results

- Presence of conference space
  - No specific data in the CBECS survey
  - Presence of conference space will impact
    - Total floor area
    - Number of rooms per square foot
  - Over 95% of the 65 hotels that provided data to EPA reported conference space
    - Your hotels are generally larger than CBECS or Portfolio Manager
    - Your hotels are more likely to have conference space
  - CBECS hotels and your hotels achieve similar rating distribution with the models
    - There is no evidence for a bias with respect to conference facilities
    - The impact of conference facilities appears to be addressed through the use of size and rooms/square foot

Resorts

- Limited information in the CBECS data set
- Because resorts are not well represented by CBECS,
  - ***EPA cannot guarantee that the rating will work for resorts***
- In addition to the 65 hotels that you provided, you provided data for 8 resorts
  - Resort ratings range from 40 to 80 on average
  - It is ***possible*** that the revised model will work for resorts
  - It is ***unknown*** whether the rating is accurate for resorts
- EPA would like to review more of your resort data to understand the applicability of the model for resorts
  - Can you provide data by 10/15?
- EPA will review additional resort data.
  - ***EPA cannot guarantee that the rating will work for resorts***

Next Steps
Hotel Model Revision

- Now and ongoing
  - Set up an account in Portfolio Manager
  - Benchmark your facilities
  - Apply for the ENERGY STAR at hotels with ratings of 75 or higher
- September 12, 2008
  - ***You*** provide any additional questions or comments
  - Send to: JSinger@icfi.com
- September – November 2008
  - EPA finalizes analysis, begins programming
- January 26, 2009
  - Revised model released in Portfolio Manager

Next Step
Resort Analysis

- September 15, 2008
  - EPA will send revised data collection template
  - Template will be shortened to focus on key variables of interest
- October 15, 2008
  - ***You*** provide data to EPA
- November 2008
  - EPA to analyze resort data
- December 2008
  - EPA will hold conference call to share the results of the resort analysis

Questions and Discussion

Please direct any additional questions or concerns to Jennifer Singer at JSinger@icfi.com